Stardust

Interstellar dust samples to end multibillion-mile trek at JSC

By Bill Jeffs

Billowing clouds of ice, dust and gases; surveyors of the solar system; voyagers from places only dreamed of by humans – these are comets. The keys that unlock the mystery of the early formation of Earth may be found in them.

"Comets are believed to be the oldest, most primitive bodies in the solar system, possibly composed of some of the basic building blocks of life," said Mike Zolensky, NASA Space Scientist in JSC's Office of Astromaterials Research and Exploration Science. "They contain the remains of materials that formed our solar system. Striking Earth over billions of years, comets contributed to our atmosphere, at the same time introducing carbon-based molecules, a fundamental element to life on this planet. In our investigation of these returning samples, we expect to find evidence that comets brought water to the Earth, Mars and other worlds, making life possible."

Samples from deep space to be returned to the Johnson Space Center in fewer than two years will help scientists determine how life formed on Earth and how water was delivered to the inner solar system.

The Stardust spacecraft's precious cargo of cometary samples and interstellar dust will be delivered to the Curatorial Facility at JSC in January 2006, concluding a journey of billions of miles. There scientists will make the first analyses of the particles, searching for clues that may for the first time reveal the true nature of comets, their role in the early history of the solar system, and, possibly, the origin of water and organic matter on Earth and Mars.

Having traveled two billion miles across cold, interstellar-dust-swept space in just under five years, NASA's Stardust spacecraft encountered its target, comet Wild 2, on Jan. 2. Telemetry data gathered during Stardust's 12-minute flight through a storm of cometary particles at six times the speed of a bullet indicate that the spacecraft encountered several high-speed jets of particles. The spacecraft took images of the comet nucleus with unprecedented detail, which will revolutionize the study of the geology and history of these icy bodies.

The spacecraft is now on its two-year, 708-million-mile trek back to Earth, where it will drop off a capsule containing the samples at the U.S. Air Force's Utah Test and Training Range in January 2006. The capsule will be immediately taken to JSC where the samples will be examined and then stored.

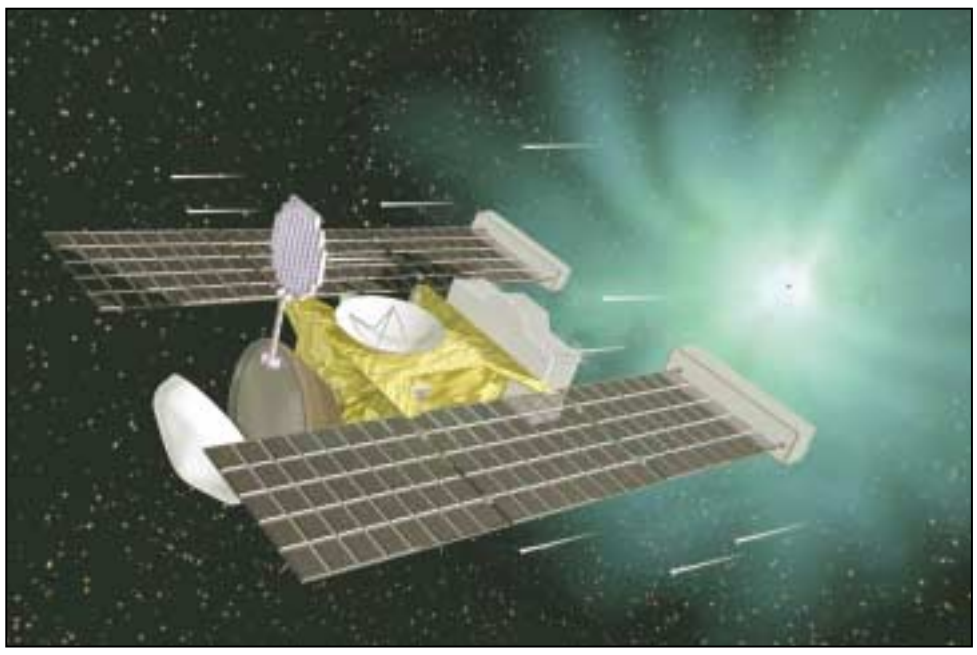
ARES scientists are key members of the Stardust science team. Fred Horz and Zolensky, co-investigators on the mission, helped design and test the silica aerogel, the magic material that captured and now holds the comet grains. They also developed many of the techniques that will be used to extract the cometary and interstellar grains from the aerogel.

In addition to capturing samples of cometary material for return to Earth, Stardust will collect and return grains from a newly discovered stream of particles from interstellar space. These samples may provide a window into the distant past, helping scientists around the world unravel some of the mysteries surrounding the birth and evolution of the solar system and distant stars.

Over the next year, a dedicated handling and curation lab will be built in Building 31 at JSC. The samples will arrive in January 2006 for initial characterization and ultimate curation. Horz and Zolensky are sample analysis leads for this effort. Zolensky will become the sample curator.

"This is a real time of change at ARES," said Gordon McKay, manager of the Astromaterials Research Office. "We are adding several major state-of-the-art instruments for analyzing the Stardust samples at nearly the atomic-scale." Curation efforts will undergo a similar metamorphosis in order to process samples invisible to the naked eye.

The Stardust spacecraft was launched in February 1999. Stardust is the first sample return mission launched in 30 years and the first to collect material from deep space.



The Stardust spacecraft was launched on February 7, 1999, from Cape Canaveral Air Station, Florida, aboard a Delta II rocket. The primary goal of Stardust is to collect dust and carbon-based samples during its closest encounter with Comet Wild 2 – pronounced "Vilt 2" after the name of its Swiss discoverer.

CLOCKWISE FROM LEFT

This photo illustrates the excellent insulating properties of aerogel. The crayons on top of the aerogel are protected from the flame underneath, and are not melting.

Aerogel and Dr. Peter Tsou, JPL scientist. Though it has a ghostly appearance like a hologram, aerogel is very solid. It feels like hard Styrofoam to the touch. The aerogel used by Stardust is specially manufactured at JPL.

In an experiment using a special air gun, particles are shot into aerogel at high velocities. A close-up of particles that have been captured in aerogel are shown here. The particles leave a carrot-shaped trail in the aerogel.